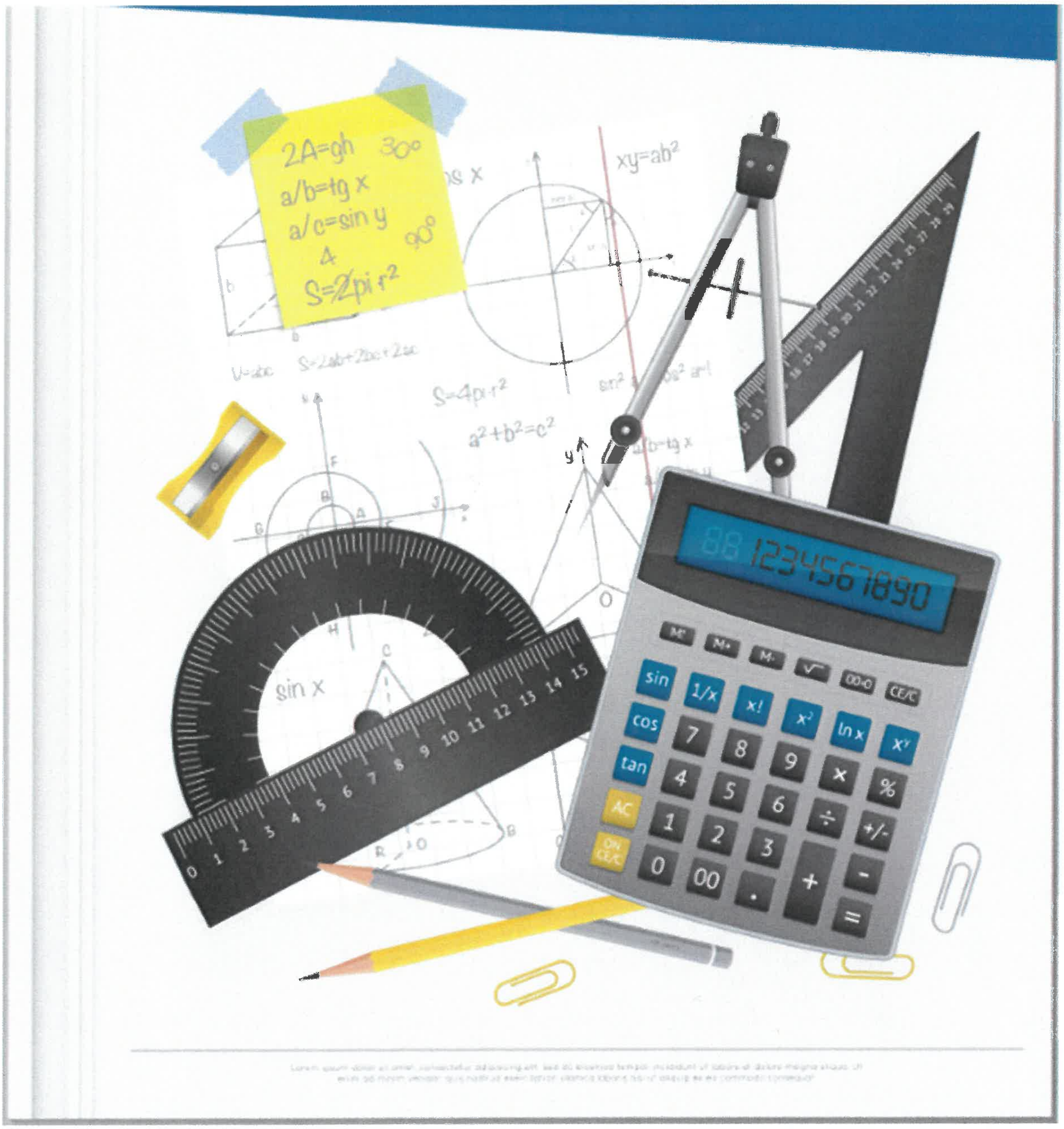
Madani Girls Maths: Knowledge Organiser Key Stage 3



How do we revise with our Knowledge Organisers?

Record It

Record yourself on your phone or tablet reading out the information. These can be listened to as many times as you want!

Teach it!

Teach someone your key facts and the get them to test you, or even test them!

Flash Cards

Write the key word or date on one side and the explanation on the other. Test your memory by asking someone to quiz you on either side.

Back to front

Write down the answers and then write out what the questions the teacher may ask to get those answers.

Hide and Seek

Read through your knowledge organiser, put it down and try and write out as much as you can remember. Then keep adding to it until its full!

Sketch it

Draw pictures to represent each of the facts or dates. It could be a simple drawing or something that reminds you of the answer.

Post its

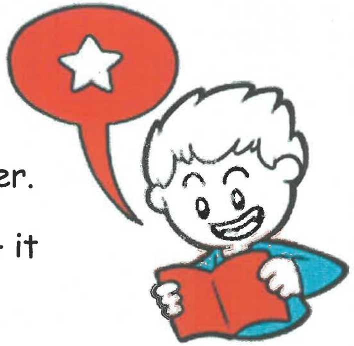
Using a pack of post-it notes, write out as many of the keywords or dates as you can remember in only 1 minute!

Practice!

Some find they remember by simply writing the facts over and over again.

Read Aloud

Simply speak the facts and dates out loud as you're reading the Knowledge Organiser. Even try to act out some of the facts - it really helps you remember!



NUMBER SKILLS

What do I need to be able to do?

You should be able to:

- Understand properties of addition and subtraction
- Understand properties of multiplication and division
- Use formal methods of addition and subtraction for integers
- Use formal methods of multiplication and division for integers
- Add and subtract directed numbers
- Multiply and divide directed numbers
- Understand and use order of operations with positive and negative integers

Key Words

- Commutative: changing the order of operations does not change the result
- Associative: when you add or multiply you can do so regardless of how the numbers are grouped
- Inverse: the operation that undoes what was done by the previous operation
- Subtract: taking away one number from another
- Negative: a value less than zero
- Debit: money that leaves a bank account
- Credit: money that goes into a bank account
- Integer: a whole number
- Product: multiply terms
- Operation: a mathematical process

Addition

Addition is commutative

2 + 4 = 4 + 2

The order of addition doesn't change the result

Addition is associative

6 + (3 + 4) = (6 + 3) + 4

It doesn't matter how you group the numbers

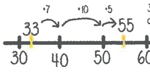
Formal written method:

	H	T	U
	3	4	2
+	1	4	9
	4	9	1
		1	

Remember the place value for each column!

Models to help with addition

- Number lines:



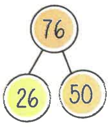
So we can say 33 + 7 + 10 + 5 = 55, or 33 + 22 = 55

- Bar models:

100	
47	53

So we can say 47 + 53 = 100

- Part/Whole diagrams:



So we can say 26+50= 76

Subtraction

Subtraction is NOT commutative or associative

12 - 8 ≠ 8 - 12

When you subtract, the order must stay the same.

Formal written method:

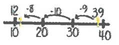
	H	T	U
	5	$^{2}3$	$^{1}2$
−	2	1	6
	3	1	6

Remember 0 is a place holder!

	2	0	8
−	0	0	4

Models to help with addition

- Number lines:



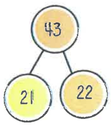
So we can say 39 - 9 - 10 - 8 = 12, or 9 - 27 = 12

- Bar models:

80	
24	56

So we can say 80 - 24 = 56 & 80 - 56 = 24

- Part/Whole diagrams:



So we can say 43 - 21 = 22 & 43 - 22 = 21

Written Methods for Multiplication

LONG MULTIPLICATION:

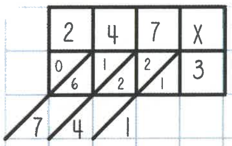
	2	4	7
x	1	2	3
	7	4	1

GRID METHOD:

X	200	40	7
3	600	120	21

600 + 120 + 21 = 741

GELOSIA:

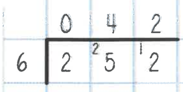


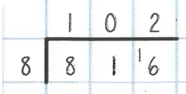
REPEATED ADDITION:

	H	T	U
	2	4	7
	2	4	7
+	2	4	7
	7	4	1
	1	2	

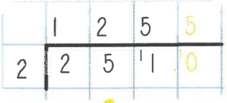
Written Methods for Division

SHORT DIVISION:



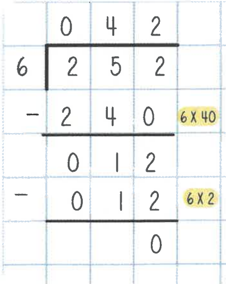


SHORT DIVISION with remainders:



Continue after the decimal point! If you start to get a repeating decimal, stop

LONG DIVISION:



This method relies on you being comfortable with multiples of your divisor (in this case, 6)!

Calculations with Directed Numbers

Addition

2 + - 3

Remember; If I add a negative, I am adding something that will make it smaller, so it is the same as subtracting that number!

2 - 3 = -1

Subtraction

2 - - 3

Remember, If I subtract a negative, I am taking away the amount that wis making it smaller, so it is the same as adding that number!

2 + 3 = 5

Generalisation.

\+ - = - - - = +

Multiplication

2 x - 3

'2 lots of -3'

= -6

-2 x -3

Think of this as the negative of 2 x -3

= 6

Division

Remember that multiplication and division are inverse operations.

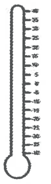
Eg 6 ÷ -3 = -2

-6 ÷ 2 = -3

Generalisation

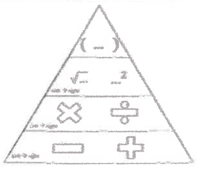
X	+	−
+	+	−
−	−	+

Models to help



It can be helpful to put calculations involving directed numbers into real life contexts. Think about temperate or bank accounts when unsure

Order of Operations



Example 1

(4 x 7) + 3

So we need to evaluate the brackets first; 4x7 =28

This is now 28 + 3 = 31

Example 2

$(6 + 4 - 3)^2 \times 4$

So we need to evaluate the brackets first and we work left to right; 6 + 4 - 3 =7

This is now $7^2 \times 4$ = 49 x 4

= 196

Example 3

4 - 8 x 2 + 12÷4

So first we do the multiplication/division left to right; 4 - 16 + 3.

Now we do the addition/subtraction from left to right: -12 + 3 = -9

DECIMALS

What do I need to be able to do?

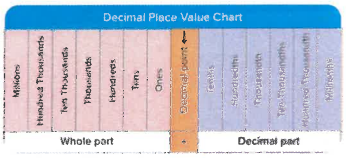
You should be able to:

- Understand place value and the number system
- Read and write decimal numbers
- Order decimals of any size
- Use inequality symbols
- Add and subtract decimals
- Multiply and divide decimals
- Use related calculations to find the answers to questions

Key Words

- Place Value: the value of a digit depending on its place in a number
- Place Holder: we use 0 as a place holder to show there are none of a particular place in a number
- Integer: a whole number that is positive or negative
- Decimal: a number with a decimal point used to separate ones, tenths, hundredths etc...
- Inequality: compares two values and indicates which is larger

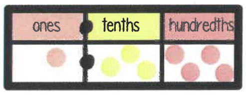
Place Value



3 2 4 7 3 5 1 • 1 4 5

"Three million, two hundred and forty seven thousand, three hundred and fifty one point one four five"

Decimal Place Value



1 one, 3 tenths and 4 hundredths

1 + 0.1 + 0.1 + 0.1 + 0.01 + 0.01 + 0.01 + 0.01

= 1 + 0.3 + 0.04

= 1.34

We say "one point three four"

Inequalities

$>$ greater than

$<$ less than

$\geq$ greater than or equal to

$\leq$ less than or equal to

$=$ equal to

$\neq$ not equal to

Examples

$5 > 3$	5 is greater than 3
$2 + 2 = 4$	2+2 is equal to 4
$5 - 3 \times 2 \neq 4$	5-3x2 is not equal to 4
$x \leq 3$	x is less than or equal to 3

Ordering Decimals

Example

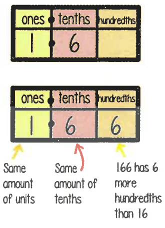
WHICH IS BIGGER, 1.6 OR 1.66?

Method 1:

Compare both numbers with the same number of decimal places

1.60
1.66 } We can clearly see that 1.66>1.6

Method 2:



Same amount of units

Same amount of tenths

1.66 has 6 more hundredths than 1.6

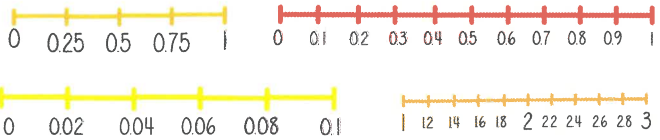
Therefore 1.66>1.6

Example WHICH IS BIGGER, 0.304 or 0.034?

We call this 0 a place holder

By looking, we can see that 0.304 > 0.034 as it has 3 tenths compared to 0

Decimal intervals on a number line



Adding Decimals

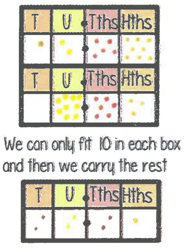
Formal written method:

```
   1 2 • 5 8
 +   9 • 6 3
 -----------
   2 2 • 2 1
 -----------
   1 1   1
```

Tths = tenths
Hths = hundredths

Visual Prompt

12.58+9.63



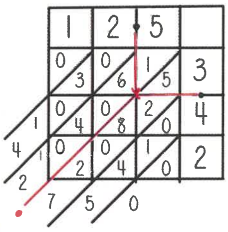
We can only fit 10 in each box and then we carry the rest

22.21

Multiplying Decimals

12.5 x 3.42

You can use any method to multiply but this way is very clear and fun!



= 42.75

Subtracting Decimals

Worded Problem

I have a £10 note and spent £4.27 on sweets. How much do I have left?

$$\begin{array}{r} \cancel{1}\,{}^{9}\cancel{0}\,.\,{}^{9}\cancel{0}\,{}^{9}\cancel{0} \\ 4\,.\,2\,7 \\ \hline 5\,.\,7\,3 \\ \hline \end{array}$$

£5.73 left

Formal Written Method

$$\begin{array}{r} \cancel{1}\,{}^{1}3\,.\,4\,8 \\ -\quad 4\,.\,2\,2 \\ \hline 9\,.\,2\,6 \\ \hline \end{array}$$

Dividing Decimals

The place holder is very important in division.

All of these give the same solution:

$1.5 \div 0.05 \rightarrow 15 \div 0.5 \longrightarrow 150 \div 5$

Multiply both values until the divisor becomes an integer

Method 1

$0.12 \div 0.003$
$1.2 \div 0.03$
$12 \div 0.3$
$120 \div 3$
$= 40$

x10 x10 x10 x10 x10 x10

Method 2

Remember that a divide sign is just an empty fraction!

$0.12 \div 0.003$ becomes $\frac{0.12}{0.003}$

Which we can rewrite as

$\frac{120}{3} = 40$

Related Calculations

Example 1

If I know that 5 x 2 = 10, what is 0.5 x 2?

$$\begin{array}{l} 5 \times 2 = 10 \\ 0.5 \times 2 = 1 \end{array}$$

÷10 ÷10

Example 2

19 x 900 = 17 100

19 x 90 = 17 10

19 x 9 = 171

19 x 0.09 = 1.71

19 x 0.0009 = 0.171

90 ÷ 10 = 90 therefore we need to divide 17 10 by 10!

÷ 100

✓ EXAMPLES

Related calculations to 6 x 8 = 48

0.6 x8 = 4.8
0.6 x 0.8 = 0.48
48 ÷ 8 = 6
4.8 ÷ 0.6 = 8

Key Points

- Keep the values in proportion.
- If you are stuck with a division, write it as a fraction and simplify that

FRACTIONS I

What do I need to be able to do?

You should be able to:

- Understand different representations of fractions
- Fully simplify fractions
- Recognise and find equivalent fractions
- Convert between mixed numbers and improper fractions
- Add/subtract any fractions
- Add/subtract mixed numbers

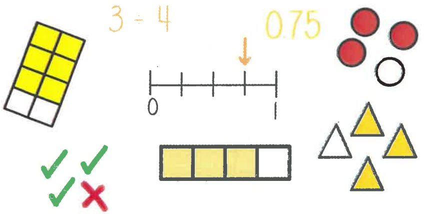
Key Words

- **Numerator**: the top number of a fraction
- **Denominator**: the bottom number of a fraction
- **Equivalent**: of equal value
- **Mixed Number**: a number with an integer and a proper fraction
- **Improper Fraction**: a fraction where the numerator is larger than the denominator
- **Coprime**: two numbers which share no common factors (except 1)

Representing Fractions

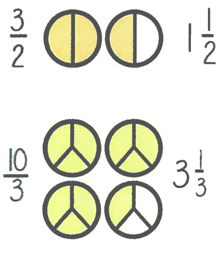
numerator $\frac{3}{4}$ denominator

We say 'three quarters' or 'three out of four'

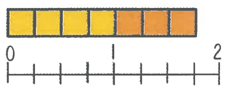


All of these show $\frac{3}{4}$ 75%

Mixed Numbers and Improper Fractions



$\frac{7}{4}$



$1\frac{3}{4}$

Fractions can represent more than one whole.

The denominator tells us how many parts make up one whole

$\frac{9}{5}$ This tells us that one whole is made up of 5 parts. We have 9 parts, so we can make one whole plus 4 parts

$1\frac{4}{5}$

Equivalent Fractions

Two fractions are equivalent if they represent the same quantity

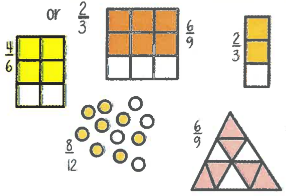
If the numerator and denominator have the same multiplier, they are equivalent

$$\frac{5}{7} \xrightarrow{\times 5} = \frac{25}{35}$$

$$\frac{1}{4} \xrightarrow{\times 2} = \frac{2}{8}$$

Each of these diagrams represents an equivalent amount.

They all show '2 out of every 3' or $\frac{2}{3}$



Simplifying Fractions

You must always simplify you fractions if you can

$$\frac{2}{4} \xrightarrow{\div 2} = \frac{1}{2}$$

HCF of 2 and 4 is 2 so to fully simplify the fraction by dividing the numerator and denominator by 2.

$$\frac{4}{12} \xrightarrow{\div 2} = \frac{2}{6} \xrightarrow{\div 2} = \frac{1}{3}$$

$$\frac{4}{12} \xrightarrow{\div 12} = \frac{1}{3}$$

Both ways get us to the right answer, just one takes a bit longer!

$\frac{8}{10}$ Sometimes a picture can help to visualise the problem

$$\frac{8}{10} = \frac{4}{5}$$

Once you cannot find a common factor, the fraction is fully simplified

$\frac{7}{10}$

This fraction is fully simplified as 7 and 10 have no common factors. We can say that 7 and 10 are COPRIME

Adding/Subtracting Fractions

Common denominators

$\frac{2}{7} + \frac{4}{7}$

$$\frac{2}{7} + \frac{4}{7} = \frac{6}{7}$$

Remember that the denominator doesn't change

$\frac{5}{8} - \frac{4}{8}$

$$\frac{5}{8} - \frac{4}{8} = \frac{1}{8}$$

We can just subtract 4 from 5!

$\frac{1}{10} + \frac{3}{10}$

$$\frac{1}{10} + \frac{3}{10} = \frac{4}{10} \xrightarrow{\div 2} = \frac{2}{5}$$

4 and 10 have a common factor (2)!

You must always fully simplify you fractions

Adding/Subtracting Fractions

Common multiples

$\frac{3}{5} + \frac{1}{10}$

10 is a multiple of 5 (5 x 2) so, using equivalent fractions we can say: $\frac{3}{5} = \frac{6}{10}$

$$\frac{6}{10} + \frac{1}{10} = \frac{7}{10}$$

$\frac{3}{4} - \frac{1}{12}$

12 is a multiple of 4 (4 x 3) so, using equivalent fractions we can say: $\frac{3}{4} = \frac{9}{12}$

$$\frac{9}{12} - \frac{1}{12} = \frac{8}{12} = \frac{2}{3}$$

Remember you must always fully simplify your fractions!

$\frac{1}{2} + \frac{2}{3} + \frac{1}{6}$

Here, we know that 2 and 3 share a common multiple of 6, so we can say: $\frac{1}{2} = \frac{3}{6}$ and $\frac{2}{3} = \frac{4}{6}$

$$\frac{3}{6} + \frac{4}{6} + \frac{1}{6} = \frac{8}{6}$$

Simplify

$$= \frac{4}{3}$$

We need to give our answer as a mixed number

$$= 1\frac{1}{3}$$

Adding/Subtracting Fractions

Different denominators

$\frac{1}{5} + \frac{3}{4}$

We need to find a common denominator using equivalent fractions

$$\frac{1}{5} \xrightarrow{\times 4} = \frac{4}{20}$$

$$\frac{3}{4} \xrightarrow{\times 5} = \frac{15}{20}$$

$$\frac{4}{20} + \frac{15}{20}$$

$$\frac{19}{20}$$

$$\frac{3}{11} + \frac{2}{3} = \frac{9}{33} + \frac{22}{33} = \frac{31}{33}$$

the LCM of 3 and 11 is 33, so our equivalent fractions are, $\frac{3}{11} = \frac{9}{33}$ $\frac{2}{3} = \frac{22}{33}$

$$\frac{5}{7} + \frac{4}{9} = \frac{45}{63} + \frac{28}{63} = \frac{73}{63}$$

Remember you can find the LCM of 7 and 9 by listing their multiples;
7, 14, 21, 28, 35, 42, 49, 56, 63, 70
9, 18, 27, 36, 45, 54, 63, 72,

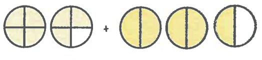
$$= 1\frac{10}{63}$$

Let's convert it to a mixed number

Adding/Subtracting Mixed Numbers

Method 1

$1\frac{3}{4} + 2\frac{1}{2}$



We have three 'wholes', $\frac{3}{4} + \frac{1}{2}$

$$\frac{3}{4} + \frac{1}{2} = \frac{3}{4} + \frac{2}{4}$$

$$= \frac{5}{4}$$

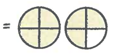
$$= 1\frac{1}{4}$$

So we have:

$$3 + 1\frac{1}{4} = 4\frac{1}{4}$$

Method 2

$1\frac{3}{4} + 2\frac{1}{2}$

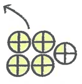


$$1\frac{3}{4} = \frac{7}{4}$$

$$2\frac{1}{2} = \frac{5}{2} \xrightarrow{\times 2} = \frac{10}{4}$$

$$\frac{7}{4} + \frac{10}{4} = \frac{17}{4} = 4\frac{1}{4}$$

How many times does 4 go into 17?
4, 8, 12, 16, 20
4 with a remainder of 1



FRACTIONS 2

What do I need to be able to do?

You should be able to:

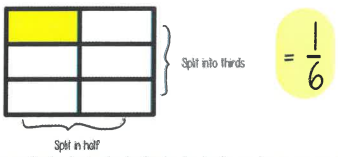
- Multiply unit fractions
- Multiply non-unit fractions
- Use cross-cancelling to simplify fractions before multiplying
- Divide integers by fractions
- Divide fractions by fractions
- Find fractions of amounts
- Use a given fraction to find the whole
- Find the reciprocal of an integer/fraction

Key Words

- Numerator: the top number of a fraction
- Denominator: the bottom number of a fraction
- Unit fraction: a fraction with a numerator of one
- Commutative: changing the order of the operations doesn't change the result
- Reciprocal: the reciprocal of a number is 1 divided by the number
- Coprime: two numbers which share no common factors (except 1)

Multiplying unit fractions

$\frac{1}{2} \times \frac{1}{3}$ "One half of one third"



$= \frac{1}{6}$

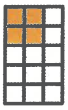
Multiplying any fractions

See cross-cancelling for a quicker method!

Example 1

$\frac{2}{3} \times \frac{2}{5} = \frac{4}{15}$

"two thirds of two fifths"



Another way to think of it:

Two parts out of three parts on two out of five rows

Example 2

$\frac{5}{7} \times \frac{14}{15} = \frac{5 \times 14}{7 \times 15} = \frac{70}{105}$

Remember to simplify where possible! $= \frac{2}{3}$

Example 3 $1\frac{1}{2} \times 2\frac{1}{3}$

$\frac{3}{2} \times \frac{7}{3} = \frac{21}{6} = \frac{7}{2}$

$= 3\frac{1}{2}$

Cross Cancelling Method

6 and 3 both have a common factor of 3, so we can divide both by 3

$\frac{2}{\underset{1}{\cancel{3}}} \times \frac{\overset{2}{\cancel{6}}}{7} = \frac{4}{7}$

This method means that we do not need to simplify our answer as it should be fully simplified already!

Example 1

$\frac{\overset{1}{\cancel{5}}}{\underset{1}{\cancel{9}}} \times \frac{\overset{2}{\cancel{18}}}{\underset{5}{\cancel{25}}}$

this becomes

$\frac{1}{1} \times \frac{2}{5} = \frac{2}{5}$

Remember; Multiply the numerators then multiply the denominators

Example 2

$\frac{\overset{1}{\cancel{15}}}{\underset{3}{\cancel{27}}} \times \frac{\overset{4}{\cancel{36}}}{\underset{3}{\cancel{45}}}$

this becomes

$\frac{1 \times 4}{3 \times 3} = \frac{4}{9}$

Dividing integers by a unit fraction

$3 \div \frac{1}{3}$ Think of this as 'how many times does a third go into 3?'

there are three thirds in one whole, so there are 9 thirds in 3 wholes

Reciprocals

A number multiplied by its reciprocal is always 1

$2 \times \frac{1}{2} = 1$

$5 \times \frac{1}{5} = 1$

The reciprocal of a is $\frac{1}{a}$

Dividing by a fraction, $\frac{1}{a}$, is the same as multiplying by its' reciprocal, a.

Example:

$3 \div \frac{1}{3} = 9$

$3 \times 3 = 9$

Dividing Fractions

Example 1

$\frac{2}{3} \div \frac{5}{7}$

$\frac{2}{3} \times \frac{7}{5}$

$\frac{2 \times 7}{3 \times 5}$

$\frac{14}{15}$

Example 2

$\frac{5}{12} \div \frac{25}{18}$

$\frac{\overset{1}{\cancel{5}}}{\underset{2}{\cancel{12}}} \times \frac{\overset{3}{\cancel{18}}}{\underset{5}{\cancel{25}}}$

$\frac{1 \times 3}{2 \times 5}$

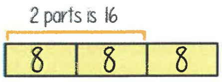
$\frac{3}{10}$

Finding Fractions of Amounts

Find $\frac{1}{2}$ of 10 "Share 10 into 2 equal parts"

Find $\frac{2}{3}$ of 24

$\frac{1}{3}$ is 8 as 24÷3=8

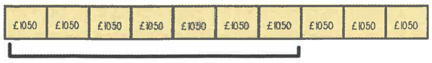


Each part must be worth 8

$\frac{2}{3}$ of 24 = 16

Find $\frac{7}{10}$ of £105

£105 ÷ 10 = £10.50

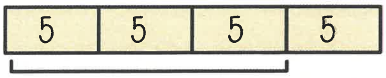


7 x £10.50 = £73.50

$\frac{7}{10}$ of £105 = £73.50

Reverse Fractions of Amounts

$\frac{3}{4}$ of a number is 15. What is the number?

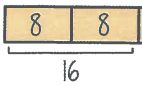


15

If 3 parts = 15, then one part must = 5

The original number was 20

$\frac{2}{3}$ of a number is 16. What is $\frac{3}{4}$ of the number?

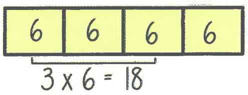


16

If 2 parts = 16, then one part must = 8

The number is 8 x3 = 24. So what is $\frac{3}{4}$ of 24?

One quarter is 6

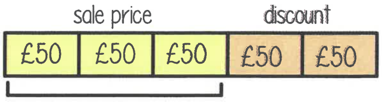


3 x 6 = 18

= 18

Worded problem

A TV is on sale for 2/5 off the price. It now costs £150. How much did it cost originally?



£150

So the original price of the TV was 5 x £50 = £250

FDP EQUIVALENCE

What do I need to be able to do?

You should be able to:

- Convert fluently between fractions, decimals and percentages
- Order fractions, decimals and percentages
- Know the key FDP equivalences

HIGHER TIER ONLY

- Covert recurring decimals into fractions

Key Words

- Percent: parts per hundred
- Fraction: how many parts out of a whole
- Decimal: a number with a decimal point used to separate ones, tenths, hundredths etc…
- Tenth: one whole split into 10 parts
- Equivalent: of equal value
- Recurring decimal: a decimal number with a digit that repeats forever

Percentages to Decimals

Convert 37% to a decimal

Remember this means 37 out of 100 or 37 hundredths. If 1 hundredth is 0.01, 37 hundredths would be 0.37

12% = 0.12
123% = 1.25
85% = 0.85
0.1% = 0.001

Percentage ⟶ Decimal, ÷ 100

Percentages to Fractions

Convert 37% to a fraction

Remember this means 37 out of 100. We can write this as $\frac{37}{100}$ ⟵ This is fully simplified!

$12\% = \frac{12}{100} = \frac{3}{25}$

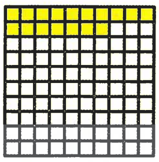
$123\% = \frac{123}{100} = 1\frac{23}{100}$

$85\% = \frac{85}{100} = \frac{17}{20}$

Percentage ⟶ Fraction, write over 100 and then simplify

Visual aids

Sometimes, it can be helpful to draw a diagram to help understand what is happening.



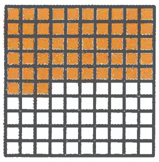
Here are 100 squares. I have 17 yellow squares.

The fraction of yellow squares is $\frac{17}{100}$

The percentage of yellow squares is 17%

I want to make 0.53 of this big square orange.

So I want to make 53 hundredths orange.
This is the same as 53% or $\frac{53}{100}$



Decimals to Percentages

Convert 0.63 to a percentage

0.63 is equal to 6 tenths plus 3 hundredths or 63 hundredths. So 0.63 = 63%

0.23 = 23%
0.535 = 53.5%
0.02 = 2%
2.13 = 213%

Decimal ⟶ Percentage, x 100

Decimals to Fractions

Always make sure that you fully simplify your fraction!

Convert 0.63 to a fraction

0.63 is equal to 6 tenths plus 3 hundredths or 63 hundredths. We can write this as $\frac{63}{100}$

$0.23 = \frac{23}{100}$

$0.535 = \frac{535}{1000} = \frac{107}{200}$

$0.02 = \frac{2}{100} = \frac{1}{50}$

Here we have 5 tenths, 3 hundredths and 5 thousandths or 535 thousandths

Recurring Decimals to Fractions

HIGHER TIER ONLY

Example (ONE RECURRING DIGIT)

Convert $0.\dot{3}$ to a fraction

3.333… - 0.333… = 3

$x = 0.3333\ldots$
$10x = 3.3333\ldots$

10x - x = 9x

$9x = 3 \longrightarrow x = \frac{3}{9} = \frac{1}{3}$

Example (TWO RECURRING DIGITS)

Convert $0.\dot{3}\dot{5}$ to a fraction

$x = 0.353535\ldots$
$100x = 35.353535\ldots$

Because we have two digits that are repeating, we need to multiply it by 100!

$99x = 35 \longrightarrow x = \frac{35}{99}$

Example

Convert $0.2\dot{5}$ to a fraction

25.555… -2.55… = 23

Here, we cannot just take 2.555 away from 0.255 as we will not reduce it to an integer

$x = 0.255555\ldots$
$10x = 2.5555555\ldots$
$100x = 25.55555$

100x - 10x = 90x

$90x = 23 \longrightarrow x = \frac{23}{90}$

Fractions to Decimals

Convert $\frac{2}{5}$ to a decimal

Remember a divide symbol is an empty fraction, so this is the same as 2 ÷ 5 = 0.4

$$5\overline{)\,2.{}^{2}0\,}\quad 0.4$$

Remember

$\frac{1}{10} = 0.1$ $\frac{1}{4} = 0.25$ $\frac{1}{2} = 0.5$

Fractions to Percentages

Convert $\frac{2}{5}$ to a percentage

Here we need to be confident with equivalent fractions. We know percent means out of 100 so we need to find an equivalent fraction with a denominator of 100.

$\frac{2}{5} = \frac{40}{100} = 40\%$

Ordering FDP

Remember ascending means from smallest to largest

Put in ascending order
0.3, $\frac{1}{3}$, 0.303, 35%, $\frac{31}{100}$

1. Choose a form to compare them in, here let's choose to compare them as decimals

   0.3, $0.\dot{3}$, 0.303, 0.35, 0.31

2. Put them in ascending order: 0.3, 0.303, 0.31, $0.\dot{3}$, 0.35

3. Convert them back to their original form

   0.3, 0.303, $\frac{31}{100}$, $\frac{1}{3}$, 35%

Key FDP Equivalences

www.cazoommaths.com

You are expected to know some of the key FDP equivalences without working them out

Decimal	Percentage	Fraction
0.5	50%	$\frac{1}{2}$
0.25	25%	$\frac{1}{4}$
0.75	75%	$\frac{3}{4}$
0.2	20%	$\frac{1}{5}$
0.1	10%	$\frac{1}{10}$
$0.\dot{3}$	$33.\dot{3}\%$	$\frac{1}{3}$

PERCENTAGES

What do I need to be able to do?

You should be able to:

- Find percentages of amounts
- Increase or decrease by a percentage
- Find percentage change
- Find the original amount.
- Express one number as a fraction of another
- Increase or decrease using multipliers
- Work with simple interest
- Work with compound interest

Key Words

- Percent: parts per hundred
- Simple Interest: interest calculated as a percent of the original amount
- Compound Interest: interest calculated on the amount borrowed plus the previous interest
- Multiplier: the number that you are multiplying by
- Increase: make bigger
- Decrease: make smaller

Percentage of an Amount

Find 10% of 300

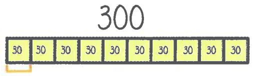
300 shared into 10 equal parts (300 ÷ 10)

÷10

100% of 300 = 300

10% of 300 = 30

÷10



Find 30% of 240

÷10

100% of 240 = 240

10% of 240 = 24

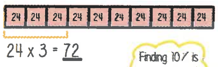
x3

30% of 240 = 72

÷10

x3

A bar model to help visualise it:



24 x 3 = 72

Finding 10% is always a good place to start!

Find 81% of 480

100% of 480 = 480
10% of 480 = 48
1% of 480 = 4.8

100% of 480 = 480
10% of 480 = 48
80% of 480 = 384

80% + 1% = 81% so we need to add 4.8 and 384;

81% of 480 = 388.8

Percentage Increase/Decrease

An antique clock has increased in value by 12% If it's original price was £400, what is the new price?

Method 1

12% increase means we have 112% of the original price. So we are now finding 112% of £400

100% of £400 = £400
10% of £400 = £40
2% of £400 = £8

112% of £400 = £448

Method 2

We need to find 12% of £400

100% of £400 = £400
10% of £400 = £40
2% of £400 = £8

12% of £400 = £48

We are increasing by 12%, so adding 12% on.
£400 + £48 = £448

Helpful Percentages

It is helpful to remember the relationships between some percentages to help speed up the process!

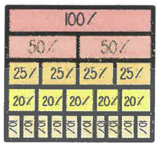
50% is half of 100%. To find 50% of something, we can divide it by 2

25% is a quarter of 100%. To find 25% of something, we can divide it by 4.

10% is one tenth of 100%. To find 10% of something, we can divide it by 10.

20% is one fifth of 100%. To find 20% of something, we can divide it by 5.

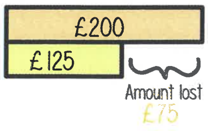
A useful one to remember: 12.5% is one eighth of 100% (as it is half of 25%)



Percentage Change

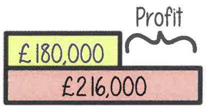
$$\frac{\text{Difference in value}}{\text{Original value}} \times 100$$

I bought a phone for £200. A year later it sold for £125. What was the % loss?



$$\frac{75}{200} \times 100 = 37.5\%$$

I bought a house for £180,000. I sold it for £216,000. What was the % profit?



Profit = £216,000 - £180,000
= £36,000

$$\frac{36{,}000}{180{,}000} \times 100 = 20\%$$

Expressing One Number as a Percentage of Another

Express 12 as a percentage of 20

$$\frac{12}{20} = \frac{60}{100} = 60\%$$

Equivalent fractions

37 out of 50 people in a class are Manchester United fans What percentage of the class support Manchester United?

$$\frac{37}{50} = \frac{74}{100} = 74\%$$

Equivalent fractions

Multipliers

What multiplier wold represent an increase of 15%?

We are finding 100% + 15%, so 115%.

As a decimal this is 1.15

What multiplier wold represent an decrease of 15%?

We are finding 100% - 15%, so 85%.

As a decimal this is 0.85

Compound Interest

I put £1000 in a bank account. It earns compound interest of 10% per year. How much will be in the account after 5 years?

INTEREST:

Compound interest means we work out the interest each year and the original amount plus any interest in the account.

- 10% of £1000 = £100.

So after year 1, the account will have £1100.

- 10% of £1100 = £110

So after year 2, the amount is £1210 etc...

If we are increasing by 10% each time, this is the same as finding 110% of the amount, or multiplying by 1.1 (see multipliers). So another way we can work this out is:

£1000 x 1.1 x 1.1 x 1.1 x 1.1 x 1.1

5 years

Or £1000 x 1.1^5 = £1610.51

I know which account I'd go for!

Finding the Original

60% of a number is 48. What is the number?

60% of x = 48
10% of x = 8
100% of x = 80

A bar model to help visualise it:

48

As a quick sense check, our answer should be BIGGER than 48! Always make sure you look back at your answer and make sure it makes sense.

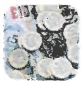
A pair of shoes are on sale for 87.5% off. The sale price is £49.50, how much did they cost originally?

87.5% off means we are left with 12.5% So 12.5% = £49.50.

12.5% of x = £49.50
25% of x = £99
100% of x = £396

Simple Interest

I put £1000 in a bank account. It earns simple interest of 10% per year. How much will be in the account after 5 years?



INTEREST:

Simple interest means we calculate the interest the initial amount will earn and add that amount on each year

10% of £1000 = £100.

So each year, the account will gain £100 interest.

5 years

£1000 + (£100 x 5)

= £1500

ALGEBRA I

What do I need to be able to do?

By the end of this unit, you should be able to:

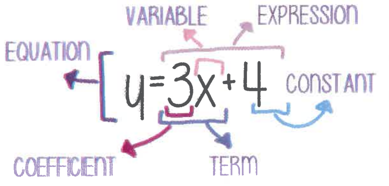
- simplify expressions by collecting like terms
- simplify expressions involving multiplication
- substitute positive & negative integers into expressions
- multiply a term over a single bracket
- expand and simplify multiple single brackets
- form expressions

Key Words

Coefficient: a number used to multiply a variable
Equation: a mathematical statement where 2 things are equal
Evaluate: work out the answer
Expand: multiply out the brackets
Expression: a mathematical sentence
Integer: a whole number
Like Terms: terms whose variables are the same
Notation: a system of symbols to represent information
Simplify: group and combine like terms
Substitute: replace a variable with a numerical value
Term: a single number or variable
Variable: a letter which represents an unknown number

Algebraic Notation

t+t+t	a x b	h ÷ 20	d x d x d
'3 lots of t'	ab	$\frac{h}{20}$	d^3
3 x t	alphabetical order	h shared equally into 20 groups	"d cubed" or "d to the power of three"
3t			



Forming Expressions

Always check the order that the operations are done in!

I think of a number, add 5 to it and then multiply it by 4

"Think of a number"	n
"Add 5 to it"	n+5
"Multiply it by 4"	4(n+5)

I think of a number, multiply it by itself, times it by 3 then take away 2

"Think of a number"	n
"Multiply it by itself"	n^2
"Multiply it by 3"	$3n^2$
"Take away 2".	$3n^2-2$

I think of a number, subtract 8 from it, multiply it by 13 and then divide it by 3

"Think of a number"	n
"Subtract 8 from it"	n-8
"Multiply it by 13"	13(n-8)
"Then divide it by 3"	$\frac{13(n-8)}{3}$

Like Terms

Like terms are where the variable is the same

♡ and 4♡ are like terms
same variable

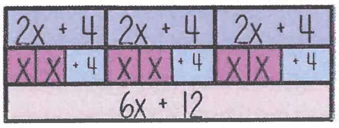
△ and ♡ are unlike terms
the variables are not the same

Like Terms ✓	✗ Unlike Terms
y, 7y	f, $4f^2$
2ab, -12ab	2d, 3ds
$4x^2$, x^2	$2x^2y$, $3xy^2$

Expanding Single Brackets

3(2x + 4) means 3 lots of (2x + 4).

Here's one way to think about it:



Another way to think about it:

$$3(2x+4) = \underline{6x + 12}$$

Collecting Like Terms

$$4x + 2b - x + 10b = \underline{3x + 12b}$$

$$5u + 3uv - 3u - 7uv = \underline{2u - 4uv}$$

Challenging Example

$$3x + 2x - x - 5x$$

$$\underline{2x^2 - 3x}$$

Basic substitution

Evaluate 4c, when c=7

If c = 7, this means the expression is asking for 4 'lots of' 7, or

$$4c = 4(7)$$
$$= \underline{28}$$

Evaluate 2a+5, when a=4

If a = 4, this means the expression is asking for 2 'lots of' 4 plus 5, or

$$2a+5 = 2(4) + 5$$
$$= 8 + 5$$
$$= \underline{13}$$

Harder Substitution

$6(x^2 + 4)$ ← remember this means x squared, plus 4, all multiplied by 6

remember
- x - = +

If x = 3;

$$6(x^2+4) = 6((3)^2+4)$$
$$= 6(9+4)$$
$$= 6(13)$$
$$= \underline{78}$$

If x = -2;

$$6(x^2+4) = 6((-2)^2+4)$$
$$= 6(4+4)$$
$$= 6(8)$$
$$= \underline{48}$$

Multiplying Terms

$$a \times a = \underline{a^2}$$

$$2b \times b = \underline{2b^2}$$

$$4c \times 3c = \underline{12c^2}$$

$$6d \times 7e = \underline{42de}$$

$$3fg \times 5fg = 3 \times f \times f \times g \times 5 \times f \times g \times g \times g = \underline{15f^3g^4}$$

Dividing Terms

Remember, a ÷ symbol is just an empty fraction!

$$d^4 \div d^3 = \frac{\cancel{d} \times \cancel{d} \times \cancel{d} \times d}{\cancel{d} \times \cancel{d} \times \cancel{d}} = \underline{d}$$

$$k \div 4k^2 = \frac{\cancel{k}}{4 \times \cancel{k} \times k} = \underline{\frac{1}{4k}}$$

$$12f^2 \div 3f = \frac{\overset{4}{\cancel{12}} \times \cancel{f} \times f}{\cancel{3} \times \cancel{f}} = \underline{4f}$$

$$18g^2h \div 12g^2h^2 = \frac{\cancel{18} \times \cancel{g} \times \cancel{g} \times \cancel{h}}{\underset{2}{\cancel{12}} \times \cancel{g} \times \cancel{g} \times \cancel{h} \times h} = \underline{\frac{3}{2h}}$$

ALGEBRA 2

What do I need to be able to do?

By the end of this unit, you should be able to :

- describe pictorial sequences and find the next term
- describe numerical sequences and find the next term
- given a rule, find the first n terms
- find positive and negative nth term
- solve problems with nth term
- recognise important sequences

Arithmetic sequences

Arithmetic sequences are one where the difference between each term is the same

1, 2, 3, 4, 5, ..   2, 5, 8, 11, ..   5, 10, 15, 20, ..

These are all examples of arithmetic sequences

Geometric sequences

Geometric sequences are ones where each term is found by multiplying previous terms by a fixed number

2, 4, 6, 8, ..   10, 30, 90, 270, ..   -3, -6, -12, -24, ..

These are all examples of geometric sequences

The language of sequences

The term-to-term rule is '+2'

The second term of this sequence is 3

1, 3, 5, 7, 9, 11, . . .

This is an arithmetic sequence as the difference between each term is the same

Finding the term to term rule

Example 1

2, 5, 8, 11, 14, . . .

+3 +3 +3 +3

The term-to-term rule is '+3'

Example 2

2, 4, 8, 16, . . .

x2 x2 x2

The term-to-term rule is 'x2'

Finding the position to term rule

2, 5, 8, 11, 14, . . .

Position	1	2	3	5	6
Term	2	5	8	11	14

It is helpful to look at it as a table

How do I get from each position to each term?

(1 x 3) - 1 = 2
(2 x 3) - 1 = 5
(3 x 3) - 1 = 8
(4 x 3) - 1 = 11
(5 x 3) - 1 = 14

The position-to-term rule is 'x3, -1'

Finding a given term in a sequence

Find the 12th term in the sequence 3n − 4?

3(12) - 4 = 36 - 4 = 32

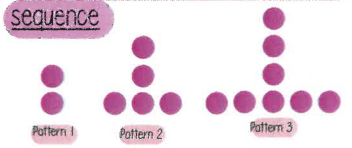
nth term

The 12th term of the sequence 3n-4 is 32

Key Words

Arithmetic: a sequence where the difference between the term is the same
Difference: the gap between two terms in a sequence
Fibonacci sequence: a sequence where the next term is found by adding the two previous terms together
Geometric: a sequence where each term is found by multiplying the previous term by a fixed number
Position: the place of a term in a sequence
Sequence: items or numbers put into a specific order
Term: a single number or variable

Finding the next term of a pictorial sequence



Each time I am adding one circle to the top and bottom on both sides, so the next pattern in the sequence is:

Finding the next term of a numerical sequence

2, 5, 8, 11, 14, . . .

Each time I am adding three, this means my term-to-term rule is '+3'

so the next number in the sequence is:

17

Generating a sequence given a rule

Example

The first term is 5, and the rule is add 4. Find the first 5 terms

5, 9, 13, 17, 21

Example

The first term is 6, and the rule is subtract 4. Find the first 5 terms

6, 2, -4, -8, -12

Finding missing terms

Same difference between all terms

Example

Find the 3rd term of the arithmetic sequence:

2, 7, __, 17, ...

The 3rd term = 5

Example

Find the 2nd term of the geometric sequence:

5, __, 20, 40

The 2nd term = 10

Finding the nth Term

Example

Find the nth term of the sequence

2, 5, 8, 11, 14, . . .

1. Find the term-to-term rule

2, 5, 8, 11, 14, . . .

+3 +3 +3 +3

2. Write out the times table of that common difference

3, 6, 9, 12, 15, . . .

3. How do we get from the times table to our sequence?

3, 6, 9, 12, 15, . . .

-1 -1 -1 -1 -1

2, 5, 8, 11, 14, . . .

the nth term is: $\boxed{3n - 1}$

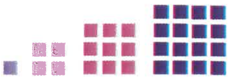
Special Sequences

Triangular Numbers

1, 3, 6, 10, 15 . . .

Square Numbers

1, 4, 9, 16, 25 . . .



Fibonacci sequence

1, 1, 2, 3, 5, 8, . . .

Each term is the sum of the previous two terms

Generating a sequence given the nth term

Example

The rule is 4n+1. Find the first 3 terms

1st term: 4(1) + 1 = 5
2nd term: 4(2) + 1 = 9
3rd term: 4(3) + 1 = 13

Substitute the number of the term in place of 'n'

The first three terms: 5, 9, 13, ...

— REASONING WITH ALGEBRA...
Forming and Solving Equations

@whisto_maths

What do I need to be able to do?

By the end of this unit you should be able to:
- Solve inequalities with negative numbers
- Solve equations with unknowns on both sides
- Solve inequalities with unknowns on both sides
- Substitute into formulae and equations
- Rearrange formulae

Keywords

Inequality: an inequality compares who values showing if one is greater than, less than or equal to another

Variable: a quantity that may change within the context of the problem

Rearrange: Change the order

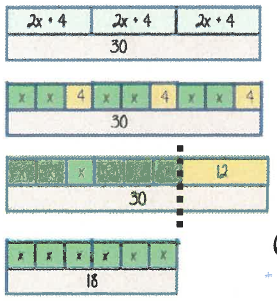
Inverse operation: the operation that reverses the action

Substitute: replace a variable with a numerical value

Solve: find a numerical value that satisfies an equation

Solve equations with brackets

R



$3(2x + 4) = 30$

Expand the brackets

$6x + 12 = 30$

$-12 \quad -12$

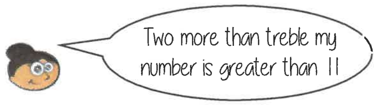
$6x = 18$

$\div 6 \quad \div 6$

$\underline{x = 3}$

Form and solve inequalities

R



Find the possible range of values

$3x + 2 > 11$

Solve

$x \xleftarrow{} \div 3 \xleftarrow{} -2 \xleftarrow{} 11$

$x > 3$

Inequalities with negatives

Method 1 Make x positive first

$2 - 3x > 17$

$+3x \quad +3x$

$2 > 17 + 3x$

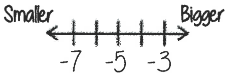
$-17 \quad -17$

$-15 > 3x$

$\div 3 \quad \div 3$

$\underline{-5 > x}$

x is true for any value smaller than -5



✓ CHECK IT!

$2 - 3(-6) = 20$

TRUE/ CORRECT

Method 2 Keep the negative x

$2 - 3x > 17$

$-2 \quad -2$

$-3x > 15$

$\div -3 \quad \div -3$

$\underline{x > -5}$

x is true for any value bigger than -5

This cannot be true...

$\underline{x < -5}$

When you multiply or divide x by a negative you need to reverse the inequality

Equations with unknown on both sides

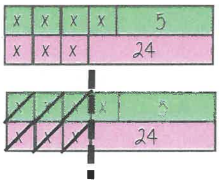
$4x + 5 = 3x + 24$

$-3x \quad -3x$

$x + 5 = 24$

$-5 \quad -5$

$\underline{x = 19}$



Inequalities with unknown on both sides

Solving inequalities has the same method as equations

$5(x + 4) < 3(x + 2)$

$5x + 20 < 3x + 6$

$2x + 20 < 6$

$2x < -14$

$\underline{x < -7}$

Check it!

$5(-8 + 4) < 3(-8 + 2)$

$5(-4) < 3(-6)$

$-20 < -18$

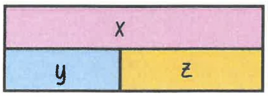
✓ -20 IS smaller than -18

Formulae and Equations

Substitute in values

Formulae – all expressed in symbols → **Equations** – include numbers and can be solved

Rearranging Formulae (one step)



$x = y + z$

Rearrange to make y the subject

$\underline{y = x - z}$

$y \xrightarrow{} +z \xrightarrow{} x$

$y \xleftarrow{} -z \xleftarrow{} x$

Using inverse operations or fact families will guide you through rearranging formulae

Rearranging can also be checked by substitution.

Language of rearranging...

Change the subject

Make XXX the subject

Rearrange

Rearranging Formulae (two step)

In an equation (find x)

$4x - 3 = 9$

$+3 \quad +3$

$4x = 12$

$\div 4 \quad \div 4$

$\underline{x = 3}$

In a formula (make x the subject)

$xy - s = a$

$+s \quad +s$

$xy = a + s$

$\div y \quad \div y$

$\underline{x = \frac{a + s}{y}}$

The steps are the same for solving and rearranging

Rearranging is often needed when using $y = mx + c$

e.g. Find the gradient of the line $2y - 4x = 9$

Make y the subject first $y = \frac{4x + 9}{2}$ Gradient $= \frac{4}{2} = 2$

— REASONING WITH GEOMETRY...

Solving ratio & proportion problems

@whisto_maths

What do I need to be able to do?

By the end of this unit you should be able to:

- Solve problems with direct proportion
- Use conversion graphs
- Solve problems with inverse proportion
- Solve ratio problems
- Solve 'best buy' problems

Keywords

Proportion: a comparison between two numbers

Ratio: a ratio shows the relative size of two variables

Direct proportion: as one variable is multiplied by a scale factor the other variable is multiplied by the same scale factor.

Inverse proportion:: as one variable is multiplied by a scale factor the other is divided by the same scale factor.

Direct Proportion

As one variable changes the other changes at the same rate.

R

4 cans of pop = £2.40

This is a multiplicative change

4 cans of pop = £2.40
x 0.5 ↓ 2 cans of pop = £1.20 ↓ x 0.5

This multiplier is the same In the same way that this would be for ratio

4 cans of pop = £2.40
x 3 ↓ 12 cans of pop = £7.20 ↓ x 3

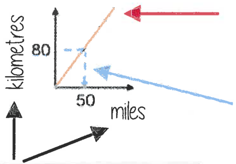
Sometimes this is easiest if you work out how much one unit is worth first

eg. **1 can of pop = £0.60**

Conversion Graphs

Compare two variables

R



This is always a straight line because as one variable increases so does the other at the same rate

Labelling of both axes is vital

To make conversions between units you need to find the point to compare – then find the associated point by using your graph.

Using a ruler helps for accuracy

Showing your conversion lines help as a "check" for solutions

Inverse Proportion

As one variable is multiplied by a scale factor the other is divided by the same scale factor

Examples of inversely proportional relationships

Time taken to fill a pool and the number of taps running

Time taken to paint a room and the number of workers

T is inversely proportional to G. When T=2 then G=20

÷ 2 × 4

T	1	2	8
G	40	20	5

× 2 ÷ 4

Best Buys

Have a directly proportional relationship

To calculate best buys you need to be able to compare the cost of one unit or units of equal amounts

	Shop A	**Shop B**
	4 cans for £1.20	3 cans for 93p
	£1.20 ÷ 4	**£0.93 ÷ 3**
Cost per item	1 can is £0.30 Or 30p	1 can is £0.31 Or 31p

Shop **A** is the best value as it is 1p cheaper per can of pop

	Shop A	
	4 cans for £1.20	3 cans for 93p
	4 ÷ £1.20	**3 ÷ £0.93**
Cost per pound	£1 buys 3.333 cans of pop	£1 buys 3.23 cans of pop

Shop **A** is still shown as being the best value but pay attention to the unit you are calculating, per item or per pound

Best value is the most product for the lowest price per unit

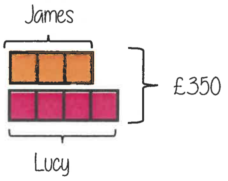
Sharing a whole into a given ratio

R

James and Lucy share £350 in the ratio 3:4. Work out how much each person earns

Model the Question

James: Lucy
3 : 4



Find the value of one part

Whole: £350
7 parts to share between
(3 James, 4 Lucy)

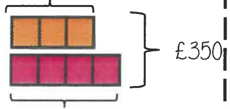
£350 ÷ 7 = £50

☐ = one part = **£50**

Put back into the question

James: Lucy
x 50 3 : 4 x 50
£150:£200

James = 3 x £50 = £150



Lucy = 4 x £50 = £200

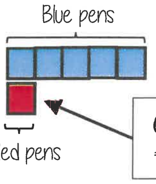
Finding a value given 1:n (or n:1)

R

Inside a box are blue and red pens in the ratio 5:1
If there are 10 red pens how many blue pens are there?

Model the Question

Blue : Red
5 : 1



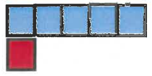
One unit = 10 pens

☐ = one part = **10 pens**

Put back into the question

Blue : Red
x 10 5 : 1 x 10
50: 10

Blue pens = 5 x 10 = 50 pens



Red pens = 1 x 10 = 10 pens

There are 50 Blue Pens

UNIT CONVERSIONS

What do I need to be able to do?

You should be able to :

- Recognise metric measures
- Convert metric measures
- Calculate with metric measures
- Convert between units of time
- Understand compound measures
- Work out compound units

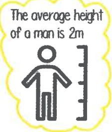
Key Words

- Length: the distance from one point to another
- Mass: a measure of how much matter is in an object
- Capacity: the amount an object can contain (usually liquids)
- Volume: the amount of 3-dimensional space an object takes up
- Convert: change a value or expression from one value to another
- Unit: any measurement that there is one of
- Imperial: a system of weights and measures originally developed in England
- Metric: a system of measuring that replaced the imperial system to fall in line with the rest of Europe
- Compound Units: units which require two types of measurement

Metric Units

Length

- Millimetres (mm)
- Centimetres (cm)
- Metres (m)
- Kilometres (km)



The average height of a man is 2m

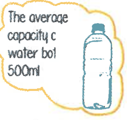
Mass

- Grams (g)
- Kilograms (kg)
- Tonnes (t)

The average weight of a 6 week old puppy is 3kg

Capacity

- Millilitre (ml)
- Litre (l)



The average capacity c water bot 500ml

Imperial Units

″ - inches
′ - feet

Length

1 inch ≈ 2.5cm

1 foot = 12 inches

1 mile ≈ 1.6km

Mass

1 ounce ≈ 28g

1 pound = 16 ounces

1 stone = 14 pounds

lb - pounds
oz - ounces
st - stone

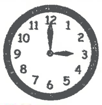
Capacity

1 pint ≈ 568ml

1 gallon = 8 pints

In your exam, you will be given the conversion from metric to imperial if needed but it's always useful to be familiar with them!

Time



Remember:
60 seconds = 1 minute
60 minutes = 1 hour
24 hours = 1 day
7 days = 1 week

DON'T FORGET; 15 minutes is often referred to as a quarter of an hour (as 15 is a quarter of 60) and 30 minutes is referred to as half an hour.

Example 1

Convert 3.4 days to hours

Step 1

1 day = 24 hours, so
3 days = 72 hours

Step 2

0.4 of a day, think of this as $\frac{4}{10}$ of a day
$\frac{1}{10}$ of a day = 2.4 hours
$\frac{4}{10}$ of a day = 9.6 hours

So 3.4 days = 81.6 hours

Example 2

Reece finishes a sudoku puzzle in 354 seconds. Daniel takes 5 minutes and 20 seconds. Who finished the quickest, and by how long?

REECE - 354 seconds

60 seconds = 1 minute
300 seconds = 5 minutes

REECE - 5 mins 54 seconds

DANIEL finished 34 seconds quicker

Length

$$\begin{tikzcd} mm \arrow[r, bend left, "\div 10"] & cm \arrow[l, bend left, "x10"] \arrow[r, bend left, "\div 100"] & m \arrow[l, bend left, "x100"] \arrow[r, bend left, "\div 1000"] & km \arrow[l, bend left, "x1000"] \end{tikzcd}$$

10mm = 1cm
100cm = 1m
1000m = 1km
REMEMBER!

Example 1

Convert 1.23m to mm

$1.23m \xrightarrow{x100} 123cm$: 1.23m = 123cm

$123cm \xrightarrow{x10} 1230mm$: 123cm = 1230mm

It is always helpful to break it up into stages. You could, of course, do this in one step!

Example 2

Convert 28400mm to km

$28400mm \xrightarrow{\div 10} 2840cm$: 28400mm = 2840cm

$2840cm \xrightarrow{\div 100} 28.4$: 2840cm = 28.4

$28.4 \xrightarrow{\div 1000} 0.0284km$: 28.4 = 0.0284km

Mass

$$\begin{tikzcd} g \arrow[r, bend left, "\div 1000"] & kg \arrow[l, bend left, "x1000"] \arrow[r, bend left, "\div 1000"] & t \arrow[l, bend left, "x1000"] \end{tikzcd}$$

1000g = 1kg
1000kg = 1t
REMEMBER!

Example 1

Convert 1.458t to g

$1.458t \xrightarrow{x1000} 1458kg$: 1.458t = 1458kg

$1458kg \xrightarrow{x1000} 1458000g$: 1458kg = 1458000g

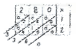
Example 2

Convert 15600 to kg

$15600g \xrightarrow{\div 1000} 15.6kg$: 15600g = 15.6kg

Example 3

One parcel weighs 280g, how much will 12 weigh? Leave your answer in kgs.



280g x 12 = 3360g

3360g = 3.36kg

ALWAYS make sure you check back to ensure you've used the right units.

Volume

$$\begin{tikzcd} ml \arrow[r, bend left, "\div 1000"] & l \arrow[l, bend left, "x1000"] \end{tikzcd}$$

1000ml = 1 L
REMEMBER!

Example 1

Convert 5000ml to litres

1000ml = 1 litre
5000ml = 5 litres

5 litres

Example 2

Convert 12.57l to ml

we multiply by 1000, so

12.57l = 12570ml

don't forget to add a 0 place holder!

Example 3

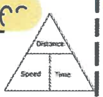
I need 10l of water. I can only buy 300ml bottles. How many bottles do I need to buy?

10l = 10,000ml

10,000 ÷ 300 = 33.333..

So we need 33.333.. bottles, but we can't buy 0.33 of a bottle! So we need to buy 34!

Compound Measures



Speed, Distance, Time

A car travels 200m in 30 minutes, calculate its speed in mph

x2 (200m in 30 mins
400m in 60 mins) x2

400mph

It takes Ryan 12 minutes to travel 15km, what is his average speed in km/h?

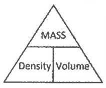
$$SPEED = \frac{DISTANCE}{TIME}$$

$$SPEED = \frac{15}{0.2}$$

SPEED = 75km/h

notice this says km/h. Our time is in minutes right now! 12 minutes is 0.2 of an hour, so instead of 12 mins, we write time as 0.2 hours

Density, Mass, Volume



Density is a way of looking at the amount of mass contained in a certain volume

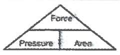
The standard units are kg/m^3 or g/cm^3

The density of air is $1.3kg/m^3$. Calculate the mass of a balloon which holds $0.0035m^3$ of air.

MASS = DENSITY X VOLUME
MASS = 1.3 x 0.0035
MASS = 0.00455kg

we know the units must be kg as the density is given in kg/m^3

Pressure, Force, Area



Pressure indicates the amount of force being exerted per unit area

A box is placed on a table an exerts a force of 200N on an area of $40cm^2$. Find the pressure.

N = newtons

$$PRESSURE = \frac{FORCE}{AREA}$$

$$PRESSURE = \frac{200}{40}$$

$PRESSURE = 5N/cm^2$

[illegible] . . .

3D Shapes

@whisto_maths

What do I need to be able to do?

By the end of this unit you should be able to:

- Name 2D & 3D shapes
- Recognise Prisms
- Sketch and recognise nets
- Draw plans and elevations
- Find areas of 2D shapes
- Find Surface area for cubes, cuboids, triangular prisms and cylinders
- Find the volume of 3D shapes

Keywords

2D: two dimensions to the shape e.g. length and width

3D: three dimensions to the shape e.g. length, width and height

Vertex: a point where two or more line segments meet

Edge a line on the boundary joining two vertex

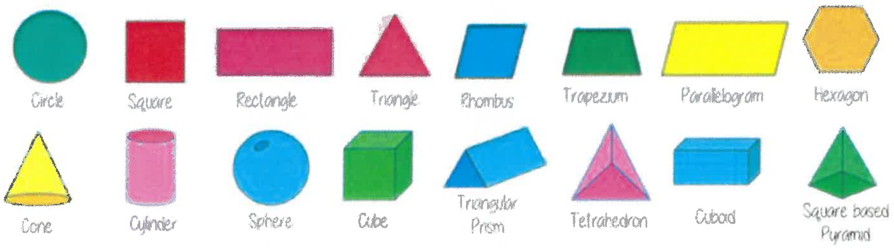
Face: a flat surface on a solid object

Cross-section: a view inside a solid shape made by cutting through it

Plan: a drawing of something when drawn from above (sometimes birds eye view)

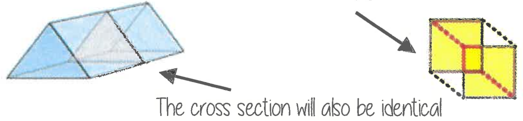
Perspective: a way to give illustration of a 3D shape when drawn on a flat surface.

Name 2D & 3D shapes



Recognise prisms

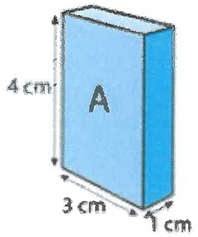
A solid object with two identical ends and flat sides

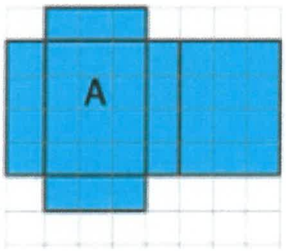


The cross section will also be identical to the end faces.

A cylinder although with very similar properties does not have flat faces so is not categorised as a prism

Nets of cuboids

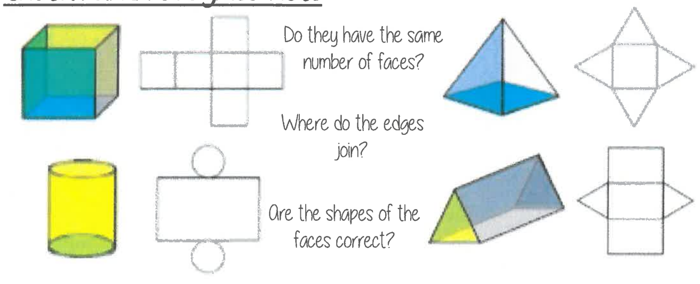




1cm grids help to draw accurately

Visualise the folding of the net. Will it make the cuboid with all sides touching

Sketch and recognise nets

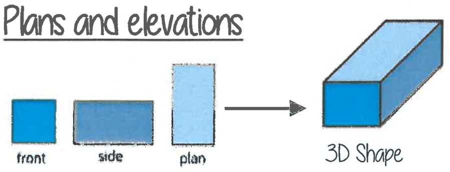


Do they have the same number of faces?

Where do the edges join?

Are the shapes of the faces correct?

Plans and elevations

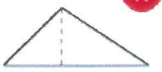


The direction you are considering the shape from determines the front and side views

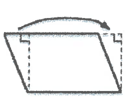
Area of 2D shapes

Rectangle
Base x Height

Triangle
½ x Base x Perpendicular height

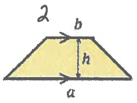


Parallelogram/ Rhombus
Base x Perpendicular height



Area of a trapezium

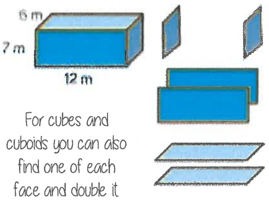
$\frac{(a+b)}{2} \times h$



Area of a circle
π x radius²

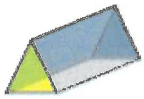
Surface area

Sketching nets first helps you visualise all the sides that will form the overall surface area



Sides	6 x 7 6 x 7	Sum of all sides is surface area
Front and back	12 x 7 12 x 7	
Top and Bottom	12 x 6 12 x 6	

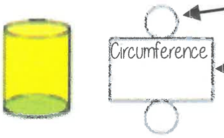
For cubes and cuboids you can also find one of each face and double it



For other shapes = not all the sides are the same, so calculate the individually

Surface area - cylinders

The area of the circle
π x radius²



The width of this face is the same as the circumference
π x diameter x height

2 x π x radius² + π x diameter x height

Volumes

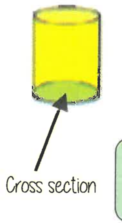
Volume is the 3D space it takes up – also known as capacity if using liquids to fill the space

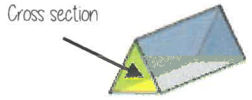
Counting cubes

Some 3D shape volumes can be calculated by counting the number of cubes that fit inside the shape.

Cubes/ Cuboids = base x width x height

Remember multiplication is commutative





Prisms and cylinders = area cross section x height

Height can also be described as depth

Areas – square units
Volumes – cube units

Areas and volumes can be left in terms of pi π

GEOMETRY I

What do I need to be able to do?

By the end of this unit, you should be able to :

- Solve simple two-step equations
- Confidently name angles using traditional conventions
- Measure and draw angles up to 360°
- Understand and apply basic angle facts
- Identify polygons and their properties
- Find missing angles in triangles and quadrilaterals

Key Words

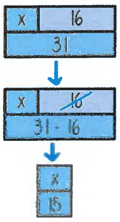
Adjacent: lying next to each other
Angle: the amount of turn between 2 lines around their common point
Diagonal: a line segment that directly joins 2 corners (vertices)
Inverse: the opposite operation
Irregular Polygon: a polygon with unequal angles and sides of different sizes
Parallel: straight lines that never meet
Perpendicular: straight lines that meet at a right angle
Polygon: an enclosed 2D shape made up of straight lines
Quadrilateral: a four-sided polygon
Regular Polygon: a polygon with equal angles and all sides the same size
Solve: to find the solution
Sum: addition

Solving One-Step Equations

There is more to this than just spotting the answer

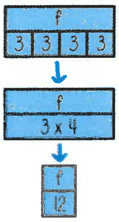
$x + 16 = 31$

$x + 16 = 31$
$16 + x = 31$
$x = 31 - 16$
$x = 15$



$\frac{m}{4} = 3$

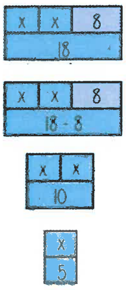
$m \div 4 = 3$
$m = 3 \times 4$
$m = 12$



Solving Two-Step Equations

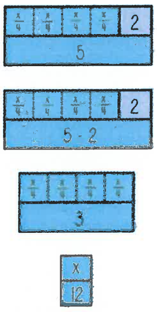
$2x + 8 = 18$

$2x + 8 = 18$
$2x = 10$
$x = 5$

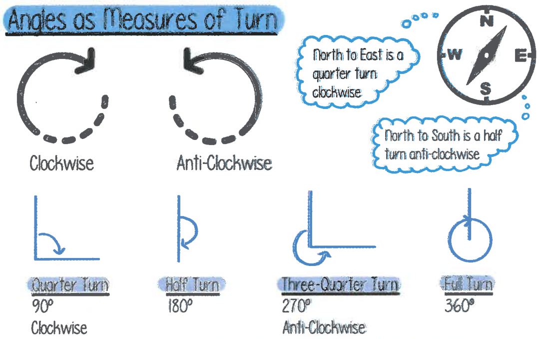


$\frac{x}{4} + 2 = 5$

$\frac{x}{4} + 2 = 5$
$\frac{x}{4} = 3$
$x = 12$

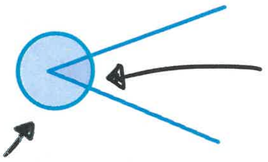


Angles as Measures of Turn



Angles over 180°

Use your knowledge of straight lines 180° and angles around a point 360°



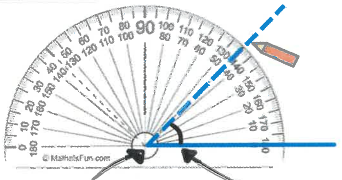
measure the smaller angle first (less than 180°)

360° - smaller angle = reflex angle

Draw Angles to 180°

Draw a 45° angle

make a mark at 45° with a pencil and join to the angle point (use a ruler)

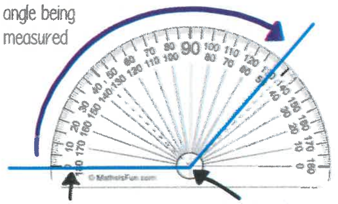


make sure the cross is at the end of the line (where you want the angle)

the angle

Measure Angles to 180°

this is the angle being measured

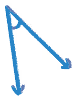


read from 0° on the base line. remember to use estimation. this is an obtuse angle so between 90° and 180°

the base line follows the line segment

make sure the cross is at the point the two lines meet

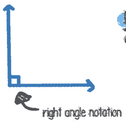
Basic Angle Rules & Notation



Acute Angles
0° < angle < 90°

Obtuse Angles
90° < angle < 180°

Reflex Angles
180° < angle < 360°



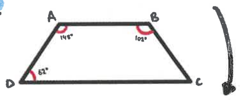
Right Angles
90°

Straight Line
180°

Angles Around a Point
360°

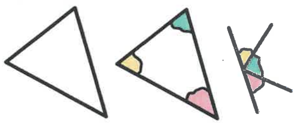
Vertically Opposite Angles
Equal

the letter in the middle is the angle
the arc represents the part of the angle



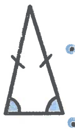
Angle Notation three letters ABC
this is the angle at B = 102°
Line Notation two letters DC
the line that joins D to C

Triangles

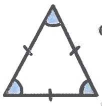


All interior angles in a triangle add up to 180°

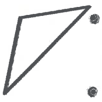
Dash notation indicates equal length sides



Isosceles Triangles
- two sides are the same length
- base angles the same size



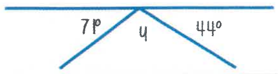
Equilateral Triangles
- all sides are the same length
- all angles the same size



Scalene Triangles
- all sides are the different lengths
- all angles different sizes

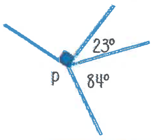
Calculating Missing Angles

Adjacent angles that share a common point on a line add up to 180°



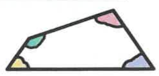
$y + 71 + 44 = 180$
$y = 180 - 71 - 44$
$y = 65°$

The sum of angles around a point is 360°

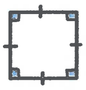


$p + 23 + 84 + 90 = 360$
$p = 360 - 23 - 84 - 90$
$p = 163°$

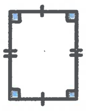
Quadrilaterals



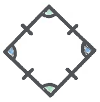
All interior angles in a quadrilaterals add up to 360°



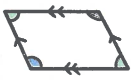
Square
all sides equal size
all angles 90°
opposite sides are parallel



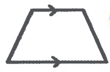
Rectangle
all angles 90°
opposite sides are equal
opposite sides are parallel



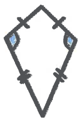
Rhombus
all sides are equal size
opposite angles are equal



Parallelogram
opposite sides are parallel
opposite angles are equal
co-interior angles



Trapezium
one pair of parallel lines



Kite
no parallel lines
two pairs of equal sides
one pair of equal angles

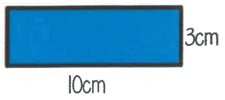
GEOMETRY 2

What do I need to be able to do?

By the end of this unit, you should be able to :

- find the perimeter of polygons
- find the area of polygons
    - including parallelograms and trapeziums
- find the perimeter and area of compound shapes
- identify 3D shapes
- work out the surface area of some 3D shapes

Area of a Rectangle



Area of a rectangle = base x height

= 10cm x 3cm

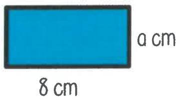
= $30cm^2$

If we know the area of a rectangle, we can work backwards to find the missing length;

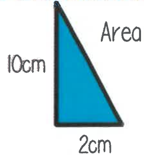
Area of rectangle = base x height

24cm = 8cm x a cm

3cm = a



Area of a Triangle

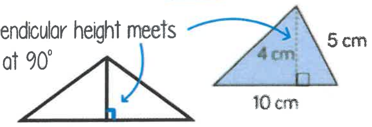


Area of a triangle = $\dfrac{\text{base x PERPENDICULAR height}}{2}$

= $\dfrac{10cm \times 2cm}{2}$

= $10cm^2$

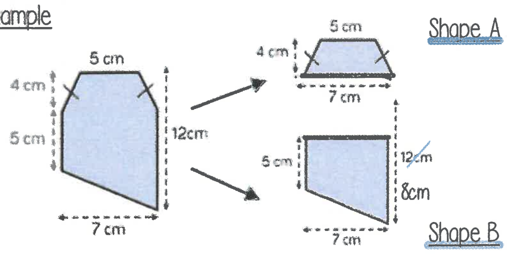
The perpendicular height meets the base at 90°



Area of Compound Shapes

To find the area of a compound shape, we can split it into 2 or more more manageable shapes first!

Example



Shape A

Area = $\dfrac{(a + b) \times h}{2}$

= $\dfrac{(5 + 7) \times 4}{2}$

= $24cm^2$

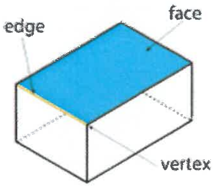
Shape B

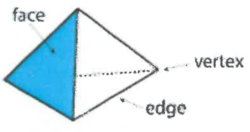
Area = $\dfrac{(a + b) \times h}{2}$

= $\dfrac{(5 + 8) \times 7}{2}$

= $45.5cm^2$

Total area = 24 + 45.5 = $69.5cm^2$





Key Words

Area: the amount of 2D space inside a shape

Compound Shape: any shape made up of two or more shapes

Congruent: the same/identical

Cross-Section: a view inside a 3D solid made by cutting through it

Edge: a line segment between two faces

Face: any flat surface on a 3D solid

Formula: a rule that uses mathematical symbols

Line Segment: part of a line

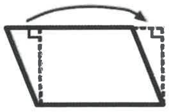
Perimeter: the distance around a 2D shape

Prism: a polyhedron with the same cross section throughout

Polyhedron: a 3D solid with flat faces

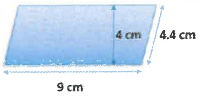
Vertex: a point where two or more lines segments meet

Area of a Parallelogram



Area of a parallelogram = base x PERPENDICULAR height

Example



Area of parallelogram = base x perpendicular height

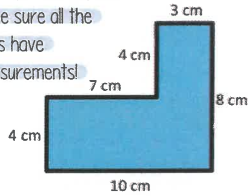
= 9cm x 4cm

= $36cm^2$

Perimeter

The distance around the outside of a 2D shape

In compound shapes, make sure all the sides have measurements!

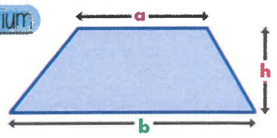


Perimeter = 4+7+4+3+8+10

= 36cm

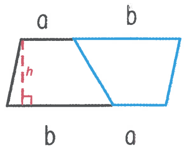
Area of a Trapezium

$\dfrac{(a + b) \times h}{2}$

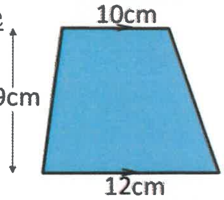


Why?

- Two congruent trapeziums make a parallelogram
- We can find the area of this by doing (a+b) x height.
- As we only want ONE, we can divide by 2!



Example



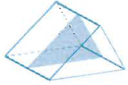
Area of trapezium = $\dfrac{(a + b) \times h}{2}$

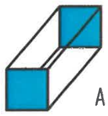
= $\dfrac{(10 + 12) \times 9}{2}$

= $99cm^2$

Recognising Prisms

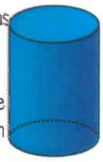
The cross section will be identical to the end faces





A solid objects with two identical ends and flat sides

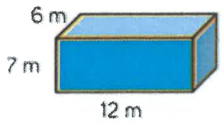
Although a cylinder has similar properties, it does not have FLAT faces, so is therefore not classed as a prism

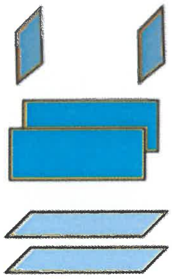


Surface Area of Cuboids

it is always a good idea to draw the faces out separately to make sure you haven't missed any!

Example





SIDES	6 x 7 6 x 7
FRONT & BACK	12 x 7 12 x 7
TOP & BOTTOM	12 x 6 12 x 6

Sum of all areas is equal to the surface area

— REASONING WITH GEOMETRY...

Rotation & Translation

@whisto_maths

What do I need to be able to do?

By the end of this unit you should be able to:

- Identify the order of rotational symmetry
- Rotate a shape about a point on the shape
- Rotate a shape about a point not on a shape
- Translate by a given vector
- Compare rotations and reflections

Keywords

Rotate: a rotation is a circular movement.

Symmetry: when two or more parts are identical after a transformation.

Regular: a regular shape has angles and sides of equal lengths.

Invariant: a point that does not move after a transformation.

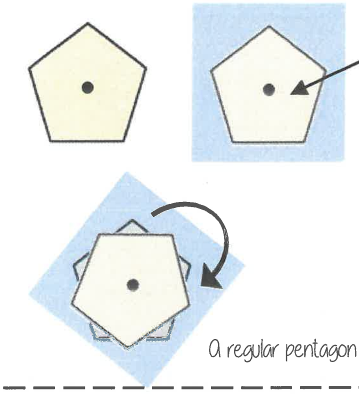
Vertex: a point two edges meet.

Horizontal: from side to side

Vertical: from up to down

Rotational Symmetry

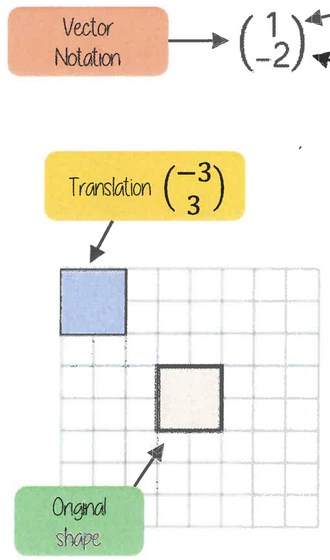
Tracing paper helps check rotational symmetry.



1. Trace your shape (mark the centre point)
2. Rotate your tracing paper on top of the original through 360°
3. Count the times it fits back into itself

A regular pentagon has rotational symmetry of order 5

Translation and vector notation

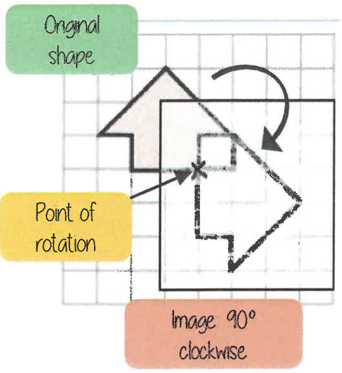


How far left or right to move
Negative value (left)
Positive value (right)

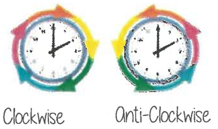
How far up or down to move
Negative value (down)
Positive value (up)

Every vertex has been translated by the same amount

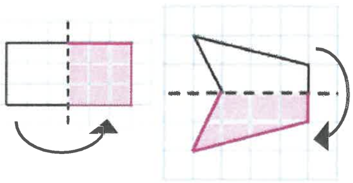
Rotate from a point (in a shape)



1. Trace the original shape (mark the point of rotation)
2. Keep the point in the same place and turn the tracing paper
3. Draw the new shape

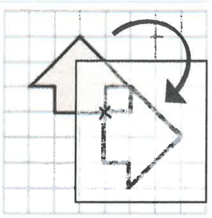


Compare rotations and reflections



Reflections are a mirror image of the original shape.

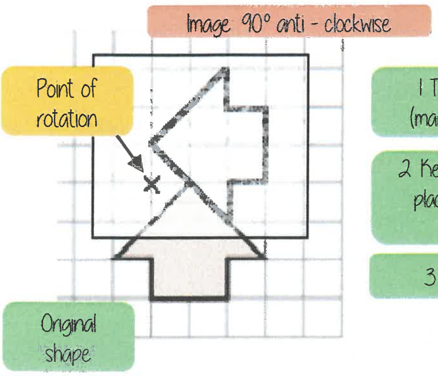
Information needed to perform a reflection:
- Line of reflection (Mirror line)



Rotations are the movement of a shape in a circular motion

Information needed to perform a rotation:
- Point of rotation
- Direction of rotation
- Degrees of rotation

Rotate from a point (outside a shape)



1. Trace the original shape (mark the point of rotation)
2. Keep the point in the same place and turn the tracing paper
3. Draw the new shape

STATISTICS 1

What do I need to be able to do?

By the end of this unit, you should be able to :
- find the mode, median, mean and range of a dataset
- find missing values given an average
- read information from scatter graphs
- read information from stem & leaf diagrams
- read information from bar charts
- compare different representations of data

Ordering numbers

-3, 8, 2, 12, -7, 0

Put these values into:

ascending order: -7, -3, 0, 2, 8, 12

descending order: 12, 8, 2, 0, -3, -7

Finding the mode of a data set

The modal value of a data set is the one that occurs the most

EXAMPLE 1

2, 2, 4, 5, 3, 2, 4

MODE = 2

EXAMPLE 2

Red, Blue, Green, Blue, Red, Blue

MODE = Blue

Finding the range of a data set

To find the range we calculate the difference between the largest and smallest value in the data set

EXAMPLE

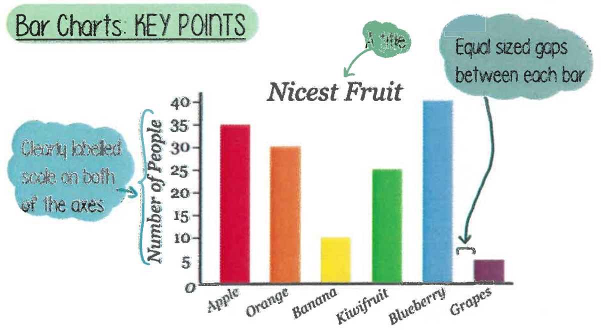
20, 2, 14, 19, 8

It can be helpful put the data in order when trying to find the largest and smallest values

Smallest value: 2
Largest value: 20
Range = 20 - 2

RANGE = 18

Bar Charts: KEY POINTS

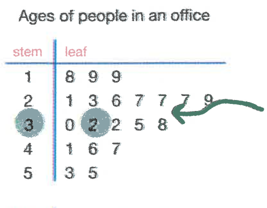


All bars have the same width

Represents discrete data

Stem & Leaf: KEY POINTS

A steam and leaf diagram is a graph with splits each data value into a 'stem' and a 'leaf'


Ages of people in an office

stem	leaf
1	8 9 9
2	1 3 6 7 7 7 9
3	0 2 2 5 8
4	1 6 7
5	3 5

key: 2 | 3 means 23 years

Always include a key!

32 is split into '3' (stem) and '2' (leaf) so we place it here

Stem & leaf diagrams are really useful when finding different averages!

Key Words

Average: a calculated 'central' value of a set of numbers
Bimodal: a data set with two modes
Continuous Data: data that can take any value (age, height, length...)
Data Set: a collection of facts, such as numbers, words etc...
Discrete Data: data that can only take given values (colour, favourite food...)
Mean: the average of the numbers in a data set
Median: the middle of a sorted list of numbers
Mode: the value that appears the most often in a data set
Range: the difference between the largest and smallest value in a data set

Finding the median of a data set

To find the median we
1 Put the data in ascending order
2 Identify the value in the middle

EXAMPLE 1

20, 2, 14, 19, 8

Step 1: 2, 8, 14, 19, 20
Step 2: ~~2~~, ~~8~~, 14, ~~19~~, ~~20~~

MEDIAN = 14

EXAMPLE 2

20, 2, 14, 19, 8, 12

Step 1: 2, 8, 12, 14, 19, 20
Step 2: ~~2~~, ~~8~~, 12, 14, ~~19~~, ~~20~~

If we have an even number of values, and two in the middle, then we need to find the number that is in the middle of those

MEDIAN = 13

Finding the mean of a data set

To find the mean we
1 Find the sum of the data
2 Divide the overall total by how many pieces of data that you have

EXAMPLE

20, 2, 14, 19, 8

Step 1: 20+2+14+19+8 = 63
Step 2: 63 ÷ 5 = 12.6

MEAN = 12.6

Choosing which average to use

Averages should be representative of the data set - so it should be compared to the set as a whole to check if it is an appropriate average

EXAMPLE

Here are the scores of 6 Year 7 students in a recent maths test:

0, 0, 10, 12, 15, 20

Let's find all of the averages!

MEAN: "add and divide" 9.5
MEDIAN: "middle" 11
MODE: "most" 0
RANGE: "difference" 20

Put the data back into context

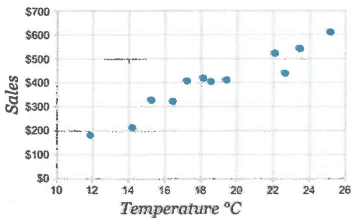
Range/Mode: just because 2 students scored 0 and one got 20, this does not represent the data

The Median or mean is the best average to represent the scores on this test

Scatter Graphs: KEY POINTS

Shows the relationship between two pieces of data

Here we can see sales being compared to temperature.



We can see clearly that as the temperature increases, the sales increase

This scatter graph could show us the relationship between sales of ice creams and temperature, or sales of sunglasses and temperature for example